

APPLICATION
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TITLE: MODULAR COMPUTER SYSTEM
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MODULAR COMPUTER SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional application of and claims priority to U.S. patent application serial no. 08/332,499, filed October 31, 1994, which is a continuation of U.S. patent application serial no. 08/120,649, filed September 13, 1993, which is a continuation of U.S. patent application serial no. 07/642,831, filed January 18, 1991.

BACKGROUND OF THE INVENTION

The present invention relates to microcomputers, or personal computers, as well as larger computers, and is particularly concerned with improving the freedom of movement of the users of such computers and enhancing the possibilities of sharing of a single computer system by a plurality of users.

While computers having a full range of capabilities have grown progressively smaller, even the smallest full-feature computer currently on the market is installed and used at a single work location.

A special class of computers, laptops, offers the advantage of freeing the user from their work station and allowing the computer to be transported and used anywhere. Of

course, this freedom and flexibility of use are at the expense of important operating features, most notably storage capacity and display capability, and secondarily memory capacity.

Because of limitations involving the relation between storage
5 and memory capacities and cost, available laptops can run only a limited number of the available business and scientific programs or are extremely expensive.

It is also known in the art to interconnect, or network, a number of computers, by cable or wireless links, to
10 facilitate the exchange of data and programs between users and to allow sharing of peripherals. However, this technique involves the interconnection of complete computers which normally remain at fixed locations.

Up to the present, there has been no system which would
15 allow the user to move easily and quickly from one location to another while enjoying all of the operating capabilities of a full-size microcomputer, although such a system would be quite desirable in many situations.

20 SUMMARY OF THE INVENTION

It is an object of the present invention to increase the mobility of a personal computer user while retaining all of the capabilities of a conventional personal computer.

Another object of the invention is to allow the user to change locations, at least over a limited area, while exerting full control over the computer.

A further object of the invention is to facilitate
5 displacement of the input and output ports of such a computer.

Yet another object of the invention is to facilitate sharing of the memory and storage systems of a computer by a plurality of users.

The above and other objects are achieved, according to
10 the present invention, by a computer system comprising: a storage and control unit including means for receiving and processing input data signals and means for producing output signals based on the input data signals; an input/output unit including means for generating input signals and output means
15 for providing a display based on output signals; and means forming a wireless link between the units for conducting data signals from the means for generating input signals to the means for receiving and processing input signals and for conducting output signals from the means for producing output
20 signals to the output means.

Since one unit of the computer need only include an input device, typically a keyboard, and an output device, typically a display, as well as a transceiver unit, this unit can be relatively light in weight and hence portable. At the same

time, the central processing unit and any desired peripherals, e.g., hard disc drives, printers, telephone modems, etc., form parts of another unit which can be allowed to remain stationary. Therefore, these peripherals can have any desired
5 size and capacity without interfering with the portability of the unit containing data input and output devices.

Such an arrangement will permit a wide variety of applications to be implemented more rapidly and conveniently. For example, the user can move with great ease from one
10 location to another within a defined work area to obtain information which can then be inputted to the computer. At each location, the user continues to control computer operation and receive an output display.

The storage and control unit can be constructed in a
15 manner similar to conventional basic computer systems or work stations, to include a CPU with microprocessor, input/output interfaces, memories and disc drives. According to the invention, such a unit will be supplemented by a wireless transceiver constructed to exchange signals with the
20 input/output unit.

The input/output unit differs from known devices in that, in its preferred form of construction, it consists only of a keyboard and a display device, along with an associated transceiver unit. The manner in which power is supplied to the

input/output unit will depend primarily on the nature of the display device. If that display device includes a cathode-ray tube, it would be most appropriate for power to be supplied from the building mains. If the display is of the liquid crystal type, the entire input/output unit, including its associated transceiver, could be powered by replaceable or rechargeable batteries. The display employed in the input/output unit could also be of the gas plasma type, or other known type.

The invention could also be employed in conjunction with workstations, minicomputers or mainframe computers and with computers connected into a network.

In addition, information, including data and programming, could be exchanged between several input/output units coupled to a single storage and control unit via wireless links.

Further, a single storage and control unit could be shared by one or more users provided with respective input/output units and a further user stationed at a keyboard and monitor which are connected to the storage and control unit by the usual connecting cables. The latter user, perhaps a teacher, could control the sharing process under control of appropriate programming hardware switches.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a perspective view of one preferred embodiment of a computer system according to the present invention.

Figure 2 is a block diagram of one suitable embodiment of a communication link between the two components of the system shown in Figure 1.

Figure 3 is a pictorial view of a second embodiment of one part of a system according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The system shown in Figure 1 is composed of two structurally separate units: an input/output unit 2: and a storage and control unit 4.

Unit 2 is composed essentially of three components, a keyboard 10, a monochrome or color display device 12 and a wireless transceiver device 14. Unit 2 will further be composed of a power supply (not shown) which may be connected to the building mains via a plug-in power cord, or which may be battery operated. The type of power supply employed will depend primarily on the nature of display device 12, since operating power for keyboard 10 and transceiver 14 can be effectively supplied by either type of power supply.

Unit 2 can be provided with interfaces for connection of alternate input devices, such as a mouse, a track ball, or a pattern recognition pad.

Because of the limited number of components forming unit 2, this can be conveniently constructed to have the general form of a briefcase, including a carrying handle 18. Unit 2 can then be easily transported from one location to another within the operating range of the wireless link associated with the computer system. Unit 2 could optionally be provided with a protective cover which would cover keyboard 10 and display device 12, and possibly also transceiver 14, when the computer system is not in use or when unit 2 is being transported from one operating location to another.

Unit 4 can be quite comparable to a basic computer system, which typically includes all necessary computer components except for display and input devices. Unit 4, thus, contains a CPU with microprocessor, memory, input/output interfaces and a variety of disc drives, including CD-ROMs. Unit 4 may be connected to any number of peripheral devices, including telephone modems, printers and larger storage units. The number of peripheral devices connected to unit 4 will not interfere with the convenience offered by the computer system according to the present invention since unit 4 is intended to remain stationary.

Unit 4 does differ from conventional consoles in that it includes a transceiver 24 which, as will be explained in greater detail below, can communicate with transceiver 14, for which purpose each transceiver is provided with an antenna 26,
5 28.

It should be apparent from the description provided thus far that all of the components of a computer system according to the invention can be produced in the conventional manner, with the exception of transceivers 14 and 24, one preferred
10 embodiment of which is shown in Figure 2.

Referring to Figure 2, keyboard 10 is typically composed of a wire matrix whose intersections are connected together by depression of respective keys. In a known manner, the wires of this matrix may be coupled to a microcontroller 30 via a
15 suitable bus 32. Microcontroller 30 can be one component of transceiver 14 or can be installed in unit 2 and connected to transceiver 14. Microcontroller 30 can be constructed in the manner disclosed, for example, in U.S. Patent Nos. 4,628,541 and 4,649,373, although other circuit arrangements are
20 possible. Essentially, microcontroller 30 includes its own clock, which need not be synchronized with the clock in unit 4. The output signal from microcontroller 30 is a serial signal identifying the current state of keyboard 10. This serial signal may be an asynchronous signal which can be

decoded in unit 4 with the aid of an auxiliary clock signal generated therein. Alternatively, the technology exists for transmitting an asynchronous signal in a form which permits automatic clock recovery at the receiving end.

5 The signal produced by microcontroller 30 is delivered to a suitable modulator 36 and from there to the input of a directional coupler 38 connected to antenna 26. Modulator 36 could include, or be supplemented by, a signal amplifier, if necessary.

10 The resulting signal emitted by antenna 26 will be received by antenna 28 of transceiver 24 and conducted 10 via a second directional coupler 42 and a suitable demodulator 44 to an input circuit within unit 4. This circuit may have the form disclosed in connection with Figure 4 of U.S. Patent No.
15 4,628,541. Of course, any other suitable receiving circuit can be employed.

20 In a conventional computer, there will be generated, at an output port, video and horizontal and vertical synchronizing signals which are supplied individually to a monitor. In a system according to the present invention, these signals are transmitted also via the wireless link, from unit 4 to unit 2. Thus, as further illustrated in Figure 2, by way of one example, the synchronizing signals, V_{sync} and H_{sync} , and the video signal are each modulated in a respective modulator

46, each modulator providing a carrier signal having a frequency which differs from one modulator to the other and which is modulated with its associated input signal.

The various signals exchanged by units 2 and 4 may be
5 analog or digital in nature. Typically, the keyboard signals will be digital and the monitor signals analog. Either type of signal may be modulated in any suitable manner without altering its basic form. The modulation can be AM or FM or spread spectrum modulation and the latter offers certain
10 advantages since it permits transmission at low power levels and is relatively immune to interference.

The output signals from modulators 46 are then delivered to inputs of a frequency multiplexer 48 and, if necessary, the multiplexed signal can be conducted through a power amplifier
15 50 and via directional coupler 42 to antenna 28.

The radiated signal arriving at antenna 26 is conducted by directional coupler 38 via an input amplifier 60 to a frequency demultiplexer 62 which acts to divide the received signal into the three carrier frequencies produced by
20 modulators 46. Alternatively, the video signal can be a composite signal which can be transmitted over a single channel and requires only a single modulator 46 and demodulator 64.

Each of the resulting signals is conducted to a 10
respective demodulator 64, from which the resulting
demodulated signals, corresponding to those supplied to
modulators 46, may be delivered to the respective inputs of
5 display device 12.

It will be appreciated that in the construction of
embodiments according to the present invention, a variety of
modulation schemes can be employed, and only one of these
schemes is illustrated and disclosed herein, purely by way of
10 example. The wireless link between antennas 26 and 28 can be
provided by an electromagnetic signal at any frequency level
sufficient to contain all of the information to be
transmitted. The wireless link could also be constituted by an
infrared signal, although at the present time this is not
15 preferred because the exchange of signals by infrared
radiation requires not only a line-of-sight relation between
units 2 and 4, but also that the units have a certain
orientation relative to one another.

If it should be desired to transmit keyboard signals from
20 transceiver 14 during periods when information signals are
being conducted from transceiver 24, the V_{sync} pulses at the
output of the associated demodulator 64 could be employed to
activate modulator 36 and initiate transmission of keyboard
data in serial form by microcontroller 30.

The form of the display signal can be varied according to the nature of display device 12. Thus, this signal may have the form of a composite video signal, a single signal containing picture and sync information, an RGB signal, etc.

5 According to another embodiment of the invention, illustrated in Figure 3, the unit 4 for Figure 1 is constructed in two parts, a unit 70 containing all of the components of a conventional CPU, and a transceiver unit 72 containing all of the components of transceiver 24 of Figures 10 1 and 2, including antenna 28, and coupled to unit 70 by an input cable 74 and an output cable 76.

This arrangement offers the notable advantage that unit 70 can be constituted by a conventional computer "box," i.e. containing a CPU, disk drives, memory, controllers and 15 interfaces, but excluding a keyboard a monitor, connected to transceiver 72 by cables 74 and 76. Thus, to utilize the present invention, the owner of a computer would need to purchase only unit 2 of Figure 1 and transceiver 72.

20 According to another embodiment of the invention, the graphics display capability of the system could be enhanced by constructing device 12 as a high resolution display device, including a suitable graphics card in unit 2 and installing a special interface card in unit 4. In a conventional computer system having graphics display capabilities, picture

information is supplied to a graphics card via a multiline data bus conducting bit signals in parallel and is stored in a memory under control of address signals generated in unit 4. The picture information is then read out to deliver picture signals to the display device. In this embodiment of the invention, the parallel bit signals containing picture information, and associated address signals, are conducted from the data bus and an address bus to the special interface card and are converted, in the special interface card, into a serial bit stream which is then supplied to a channel defined by transceiver 24. The serial bit stream is modulated and transmitted to transceiver 14. From transceiver 14, the picture information is conducted, under control of the address signals, to appropriate memory locations of the graphics card and the stored information is then supplied to the display device. With this arrangement, new picture information must be transmitted only when there is a change in some part of the displayed image. Therefore, high resolution graphics images can be displayed at input/output unit 2 without requiring a high capacity channel for transmitting the picture information. Information to update the display can be transmitted in bursts.

As noted earlier, systems according to the invention can include a plurality of input/output units 2, with the wireless

link being constructed and connected to couple a single
storage and control unit 4 to all of the input/output units 2.
In such embodiment, storage and control unit 4 is provided
with suitable programming for establishing a predetermined
5 priority of communication between storage and control unit 4
and all of the input/output units 2.

While the description above refers to particular
embodiments of the present invention, it will be understood
that many modifications may be made without departing from the
10 spirit thereof. The accompanying claims are intended to cover
such modifications as would fall within the true scope and
spirit of the present invention.

The presently disclosed embodiments are therefore to be
considered in all respects as illustrative and not
15 restrictive, the scope of the invention being indicated by the
appended claims, rather than the foregoing description, and
all changes which come within the meaning and range of
equivalency of the claims are therefore intended to be
embraced therein.